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GENERIC CONSIDERATIONS CONCERNING CARPHEPHORUS, TRILISA AND LITRISA (COMPOSITAE)

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Carphephorus Cass. (4 species), and *Trilisa* (Cass.) Cass. (2 species) and the monotypic *Litrisa* Small (merged with *Trilisa* by Robinson, 1934), are closely related genera in the Eupatorieae. They are allied to *Liatris* Schreb. and *Garberia* Gray with which they form a seemingly natural segregate of the subtribe Kuhniinae. Primarily of the Coastal Plain, they are known only from the southeastern United States; southeastern Virginia to south Florida and westward into eastern Louisiana. All of the seven species appear distinctive and present relatively little variation. The present problem is one of generic limits, the basis of which is presented in the following historical account.

In describing *Carphephorus*, Cassini (1816) stated that it differed from *Liatris* in that the receptacle was provided with pales and the pappus bristles were non-plumose. Later (1818), he recognized *Trilisa* as a subgenus of *Liatris*, as typified by *Liatris odoratissima*. The rank of subgenus was considered sufficient for this taxon because there was observed in *Liatris* a short-plumose (barbellée) pappus which was intermediate between true *Liatris* whose pappus was long-plumose (barbée), and *Trilisa* whose pappus was barbed (barbellulée). He further stated that *Trilisa* had the greatest affinity with *Carphephorus*, from which it differed by the absence of pales. Although he directly proceeded to point out that a few pales were occasionally observed even in the subgenus *Trilisa*. In 1820, Cassini raised *Trilisa* to generic status without further discussion. Not until 1828, how-

ever, were any species actually transferred to it. At this time Cassini cited *Liatris odoratissima* and *Liatris paniculata* of Willdenow (1803)[1] as species of *Trilisa* and summarized his previous comments on these genera.

It is Cassini's remark (apparently overlooked, subsequently) of the occasional presence of some pales in *Trilisa odoratissima* that has prompted the question of the generic limits in *Carphephorus* and *Trilisa*, and also *Litrisa*. The last named "genus" has only one species, *Litrisa carnosa* Small, an endemic of east, central Florida. In describing it, Small (1924) wrote, "Technically it is most closely related on the one hand to *Trilisa*, by its involucre, and on the other, to *Carphephorus*, by its chaffy receptacle." It is implied here, as has been customary, that *Trilisa* has a naked receptacle. After the publication of Small's manual (1933), Robinson (1934) noticed that Small contradicted himself by keying out *Litrisa* as having "Receptacle naked." In a study of the type collection, as well as other material, Robinson made several sketches, one of which bears the annotation, "No scales on disk." Since he then proceeded to transfer *Litrisa carnosa* to the genus *Trilisa*, rather than *Carphephorus*, the implication is again that *Trilisa* lacks pales. Presumably, if Robinson had seen any pales in *Litrisa carnosa*, he would have transferred it to *Carphephorus*, for he was not impressed by the differences in the involucres.

Upon examination of all of the species of the genera under consideration, I conclude that pales may be borne in any one of the species. They are most abundant in *C. pseudo-liatris* and *C. corymbosus*. Their number also varies, as might be expected, with the size of the heads. Since the heads are typically smaller in the two *Trilisa* species and in *Litrisa* (involucres ca. 4–5 mm. high), than in *Carphephorus* (involucres ca. 6–10 mm. high), the number of pales per head as a primary generic character would

[1] Willdenow took both epithets, "odoratissima" and "paniculata" from Walter (1788), who had employed them with "Anonymos." However, Michaux, also in 1803, transferred these "Anonymos" species of Walter to *Liatris*. According to Schubert (1942), Michaux's Flora preceded this particular volume of Willdenow's. Consequently, the citation of these binomials should be: *Trilisa odoratissima* (Michx.) Cass. and *Trilisa paniculata* (Michx.) Cass.

[2] The presence of pales in these genera is unique in the tribe Eupatorieae. Bentham (1873) says, "Receptaculum plus minus paleaceum in Decachaetae, Alomiae, et Agerati speciebus paucis et in Carphephorus." They are also present in *Hartwrightia* Gray ex S. Wats. Furthermore, they are little, if at all, specialized; the peripheral ones, particularly, are very similar to the phyllaries, with which they have been considered homologous.

seem questionable. The pales are also deciduous, a factor perhaps accounting for discrepancies in determining their presence[2] or absence.

The only other known morphological basis for these genera is found in the involucre. In *Carphephorus*, the phyllaries are well-imbricated in 3–6 series; the involucre 6–10 mm. high. In *Trilisa*, the phyllaries are in 1–2(–3) series, scarcely, if at all, imbricate, the involucre 4–5 mm. high. However, in *Litrisa*, the phyllaries are well-imbricated, but only in 2–3 series and the involucre is 4–5 mm. high.

Cytological studies (Gaiser, 1954) in these genera have yielded no evidence for the maintenance of *Trilisa* or *Litrisa* as distinct from *Carphephorus*. In all of the species $2n = 20$. "One karyotype is believed to be common to these two species [*Trilisa paniculata* and *Trilisa odoratissima*] and it has been found to be indistinguishable from that of *Carphephorus*." Concerning *Litrisa carnosa*, "The number ($2n = 20$) and approximately the same kinds of chromosomes as found in the other two species [of *Trilisa*] were sketched from cells not adequate for photography. However, lacking sufficient material for careful studies, the karyotype of this species cannot be included at this time." The only other genera in the subtribe Kuhniinae in which $n = 10$[3] are *Garberia* and *Liatris*, both of which have long been suspected of being closely related to the genera in question by their morphological similarities. Neither of these genera has been reported to have pales. The monotypic *Garberia*, represented by *G. heterophylla* (Bartr.) Merrill & F. Harper (*G. fruticosa* (Nutt.) Gray), is endemic to the sand scrubs of central Florida and is the only woody member having $n = 10$. Also, its karyotype is distinctive. Although karyotypes have not been determined for all of the species of *Liatris*, some intra-generic variation in karyotype has been detected. Certainly there is as much variation, morphological as well as cytological, in the one genus *Liatris* (cf. Gaiser, 1946; 1949; 1950) as there is in the whole *Carphephorus-Trilisa-Litrisa* complex.

As it now stands, the primary basis for *Trilisa* (including *Litrisa*, as Robinson did) seems to rest entirely on the size of the

[3] Other basic numbers in the subtribe are 9 and 11; only the South American genus, *Kanimia*, has not been examined cytologically.

involucres. If, however, *Litrisa carnosa* were transferred to *Carphephorus*, the primary generic distinction could then be based on whether or not the phyllaries were imbricate. The latter character would appear to segregate the species much more naturally. This apparently was R. M. Harper's view, also, for he collected *Trilisa carnosa* before it was described (St. Lucie Co.: flat pine woods about 2 mi. w. of Fort Pierce, Fla., 23 Aug. 1923, GH), and annotated it "*Carphephorus* (?) n. sp." This same character has been used as a primary basis for distinguishing *Brickellia* from *Kuhnia* (cf. Robinson 1913; 1917), also in the *Kuhniinae*, but having $n = 9$. Shinners (1946) considered this a very weak basis, but in this case was able to point out additional reasons to justify the continued recognition of those genera. In the present and somewhat comparable case, supplementary characters, if any, have not been found. But regardless of whether or not *Trilisa* is to be maintained as a genus, it appears best segregated at the present time on its non-imbricate phyllaries. Since the phyllaries of *Litrisa* are imbricate as in *Carphephorus*, it is proposed that *Litrisa carnosa* Small be transferred from *Trilisa* to *Carphephorus*. This action would be in agreement with McVaugh's (1945) recommendation six on the generic disposition of species having affinities with two or more genera. "Any segregate genus should be sharply delimited; that is, any species which is intermediate in one or more respects toward a more inclusive genus should be relegated to the latter. The retention of the anomalous species in the more inclusive genus will change its limits, if at all, but very slightly, and only in this way can the segregate genus be precisely defined." In this case, the "segregate genus" would be *Trilisa*, the "more inclusive genus"—*Carphephorus*, and the "anomalous species"—*Litrisa carnosa*.

Carphephorus carnosus (Small) James, comb. nov. based on *Litrisa carnosa* Small, Bull. Torr. Bot. Club **51:** 392. 1924. Type: *Small* **10658**, Istokpoga Prairie, east of Sebring, Florida, 31 Aug. 1922 (NY); photograph of type (GH). *Trilisa carnosa* (Small) Robinson, Contrib. Gray Herb. **104:** 49. 1934.

This species is endemic to the seasonally wet, low, sandy pine lands in east central to southern Florida. It is known from Brevard (GH), Charlotte (FLAS, GH), DeSoto (FLAS), Highlands (FLAS, GH), Martin (FLAS, GH), Okeechobee (FLAS, GH), Orange (FLAS, GH), Osceola (FLAS, GH), Polk (FLAS) and St. Lucie (GH) Counties.

Key to the Species

a. Phyllaries imbricate (in (2–)3–6 series), densely pubescent with eglandular trichomes or glabrous and erose-ciliate; involucre 4–10 mm. high ..... *Carphephorus* Cass.
  b. Phyllaries (at least the inner) glabrous, the margins erose-ciliate, eglandular, obtuse.
    c. Stems pubescent ..... 1. *C. corymbosus* (Nutt.) T. & G.
    c. Stems glabrous ..... 2. *C. bellidifolius* (Michx.) T. & G.
  b. Phyllaries with eglandular trichomes and colorless resin atoms (sometimes few), acute or apiculate.
    d. Basal leaves long, needle-like ..... 3. *C. pseudo-liatris* Cass.
    d. Basal leaves broad, linear or lanceolate.
      e. Basal leaves lanceolate, usually pubescent, not leathery, ascending ..... 4. *C. tomentosus* (Michx.) T. & G.
      e. Basal leaves linear or linear-lanceolate, glabrous, leathery, forming a depressed rosette (endemic to Florida) ..... 5. *C. carnosus* (Small) James.

a. Phyllaries scarcely, if at all imbricate (in 1–2(–3) series), glabrous or with few glandular trichomes or resinous atoms, the margins eciliate; involucre 4–5 mm. high ..... *Trilisa* (Cass.) Cass.
  f. Stems glabrous ..... 6. *T. odoratissima* (Michx.) Cass.
  f. Stems pubescent ..... 7. *T. paniculata* (Michx.) Cass.

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CHROMOSOME RACES IN THE CHRYSANTHEMUM LEUCANTHEMUM COMPLEX[1]

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In 1954, as the result of chromosome studies on Canadian weeds, the presence of two chromosome races in North American material of *Chrysanthemum leucanthemum* L. s.l., oxeye daisy, was detected. Subsequent study revealed that the abundant and widespread oxeye daisy of North America is diploid with 18 somatic chromosomes. Tetraploid plants do occur on this continent but the occurrences are not widespread.

I determined the number of chromosomes in 36 lots of material from different locations in Nfld., Lab., P.E.I., N.S., N.B., Que., Ont., B.C., and Me. A somatic number of 18 was determined on 32 lots of this material and the other 4 lots had 36 somatic chromosomes. The tetraploid plants were grown from seed collected at Batiscan, Lauzon and Lennoxville in the Province of Quebec and at Tidehead, New Brunswick. Cooper and Mahony (1935) counted 18 meiotic chromosomes on material from the campus of the University of Wisconsin and Martin and Smith (1955) counted 18 somatic chromosomes in material from Corvallis, Oregon. Three chromosome races of *C. leucanthemum* L. s.l., with somatic chromosome numbers of 18, 36 and 54, occur in Europe. I counted 36 chromosomes on material received from France and the U.S.S.R. and 54 mitotic chromosomes on two lots of material from Portugal. Other counts on European material were made by Polya (1950) on diploid plants and Negodi (1937), Ohrt in Tischler (1950) and Löve and Löve (1956) on tetraploid plants. Dowrick (1952) and Böcher and Larsen (1957) obtained somatic counts of 18, 36 and 54 on European material. Three tetraploid counts

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